

# A Comparison of Smokers' and Nonsmokers' Fruit and Vegetable Intake and Relevant Psychosocial Factors

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*The authors examined the relation between smoking status and fruit and vegetable (FV) consumption among a population-based sample and examined differences in psychosocial factors that may influence diet and inform intervention efforts. The authors recruited adults (N = 2,540) from 5 US health plans to participate in a Web-based dietary intervention trial. At baseline, smokers ate fewer FV servings per day ( $p < .001$ ) and were less likely to meet the 5 A Day goal ( $p < .001$ ). Smokers reported lower self-efficacy, overall motivation, and intrinsic motivation for meeting daily FV recommendations. Fewer smokers expected that eating 5 FV servings a day would reduce their risk for diabetes ( $p = .02$ ) or obesity ( $p = .008$ ). Smokers are an important target group for dietary intervention. Intervention efforts should attempt to increase smokers' motivation and confidence in their abilities to change their eating patterns and educate them about the health benefits of eating FV.*

**Index Terms:** diet, health behavior, motivation, self-efficacy, smoking

Diets rich in fruits and vegetables (FV) are associated with decreased morbidity and mortality from a variety of chronic diseases, including cardiovascular disease, stroke, hypertension, diabetes, and certain types of cancer.<sup>1</sup> Eating FV may also play an important role in managing weight and preventing obesity.<sup>2</sup> Despite the health benefits, most people fail to eat the recommended daily servings of FV. According to results from the 2005 Behavioral Risk Factor Surveillance System (BRFSS) survey, 32.6% of US adults consume 2 or more servings of fruit per day and only

27.2% of adults consume 3 or more servings of vegetables per day.<sup>3</sup> As a nation, Americans are far from reaching the *Healthy People 2010* objectives of increasing to 75% the percentage of people who consume at least 2 daily fruit servings and to 50% the percentage of people who eat at least 3 vegetable servings per day.<sup>4</sup>

Although Americans as a whole have unhealthy diets, smokers appear to have worse diets than their nonsmoking counterparts. Prior epidemiological studies have shown that smokers consume more fats, alcohol, and caffeine and less fruit, vegetables, and fiber than nonsmokers.<sup>5-7</sup> These unhealthy habits are evident even among adolescent smokers. Teenage smokers are more likely to skip meals<sup>8,9</sup> and eat less healthy foods<sup>10</sup> than their nonsmoking counterparts.

Eating more FV is an important goal for most people, but it may be particularly important for smokers. There is evidence that smokers' poorer diets may increase their risk of disease associated with oxidative stress. It is well

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documented that smokers have lower levels of circulating antioxidant micronutrients (eg, ascorbic acid,  $\alpha$ -carotene,  $\beta$ -carotene, and cryptoxanthin) than do nonsmokers,<sup>11</sup> which could be due in part to smokers' lower dietary intake of these nutrients. Antioxidants provide an important line of defense against oxidative stress,<sup>12</sup> such as that caused by smoking. Furthermore, reductions in circulating antioxidants may make smokers more susceptible to oxidative damage caused by free radicals,<sup>13</sup> thereby increasing disease susceptibility. Increased antioxidant intake is important, but several well-conducted trials have shown increased disease risk, particularly lung cancer risk, and increased mortality when smokers took vitamin supplements including  $\beta$ -carotene (vitamin A),  $\alpha$ -tocopherol (vitamin E), and retinol.<sup>14–16</sup> Different effects are observed, however, when FV intake is examined. FV consumption appears to have protective effects against lung cancer<sup>17–19,20,21</sup> and cardiovascular disease<sup>22</sup> among smokers. In fact, these effects may be even greater for smokers than nonsmokers.<sup>18,19,22</sup> Consequently, it is important for smokers to eat a well-balanced diet, including plenty of FV.

In sum, although it is important to promote healthy eating among all Americans, it may be particularly important to promote increased FV intake among smokers because these individuals generally have worse diets and may benefit from making dietary improvements. In this article, we examined whether there are differences between smokers' and nonsmokers' diets and among psychosocial factors that may influence their consumption of FV. Specifically, we compared these groups on several constructs—self-efficacy, outcome expectations, and motivation—that are key to social cognitive theory (SCT) and self-determination theory (SDT). *Self-efficacy* refers to a person's belief or confidence that he or she can attain a particular goal or perform a behavior. According to SCT, self-efficacy is critical to regulating motivation, thought processes, affect, and behavior<sup>23,24</sup> and has been shown to influence a wide variety of health behaviors,<sup>25</sup> including nutrition.<sup>26</sup> Outcome expectations are also important in SCT and serve as incentives or disincentives to action, depending on the strength of the expectation and its positive or negative valence.<sup>24</sup> Positive expectations promote action and negative expectations dissuade action. Motivation influences behavioral activation and persistence and is influenced by self-efficacy, outcome expectations, and other cognitive activities.<sup>27</sup> These constructs have been used to explain and predict dietary behavior.<sup>26,28–31</sup>

In addition to general motivation for eating FV, we examined intrinsic and extrinsic motivation. Intrinsic and extrinsic motivation are central concepts to SDT<sup>32</sup> and pro-

posed mediators of behavior change.<sup>33</sup> According to Deci and Ryan,<sup>32</sup> “intrinsically motivated behaviors are ones for which the rewards are internal to the person, while extrinsic motives are ones that the person performs to receive external rewards or avoid punishment.” This theoretical framework has been used to predict changes in smoking<sup>34,35</sup> and dietary behavior.<sup>30,31</sup> Of the 2, intrinsic motivation may be a better predictor of dietary change.<sup>30</sup>

Although many environmental and cultural factors impact dietary choice, we focused on self-efficacy, motivation, and outcome expectations because they help explain behavior and represent potentially modifiable targets for future cognitive-behavioral intervention. We hypothesized that smokers would report lower intake of FV, lower levels of self-efficacy and motivation for meeting daily dietary recommendations, less intrinsic motivation for eating more FV, and less positive outcome expectations for the health benefits of eating more FV than nonsmokers. We also looked at the qualitative differences between smokers' and nonsmokers' reasons for eating FV. To our knowledge, this is the first study to look at psychosocial factors that may help explain why smokers have poorer diets than nonsmokers. The findings have implications for creating interventions to improve the diets of smokers.

## METHODS

### Setting and Participants

This work was conducted through the Cancer Research Network (CRN), a consortium of research organizations affiliated with nonprofit integrated health care delivery systems and the National Cancer Institute (NCI; [www.crn.cancer.gov](http://www.crn.cancer.gov)). The goal of the CRN is to conduct research on cancer prevention, early detection, treatment, long-term care, and surveillance using the member populations and databases of participating health care organizations.

Adults ( $N = 2,540$ ) were recruited from 5 US health plans in the CRN (Group Health in Washington state; the Henry Ford Hospital/Health Alliance Plan in Michigan; Kaiser Permanente in Georgia; Kaiser Permanente in Colorado; and HealthPartners in Minnesota) to participate in the MENU Choices trial, an online dietary intervention study to increase FV consumption. Equal numbers of participants were targeted for enrollment at each recruitment site. The study was approved by the Institutional Review Boards of each health care organization and the University of Michigan (UM). The study Web site was developed in collaboration with UM, who also maintained the site.

To be eligible for this trial, participants had to be a current member of 1 of the health plans, be aged 21–65, and

have access to the Internet and an e-mail account that they checked at least once a week; they could not be undergoing active cancer treatment or taking a blood thinner and could not be diagnosed with a functionally compromising neurological disorder or gastroparesis. Out of the original 2,540 enrollees, 27 were dropped from the analytic dataset, leaving a final sample of 2,513 enrolled participants. Data were dropped for those participants whose baseline and follow-up data were inconsistent on key factors (eg, sex, date of birth), which suggested that the information was not provided by the same individual who had initially given consent and raised general questions about the reliability of their data. Although these decisions were made primarily to preserve the integrity of the longitudinal dataset and this article focuses on baseline data only, we report on the restricted sample to be conservative. Main results were examined with and without this subsample and were unchanged.

### Procedure

Potentially eligible adults were identified through automated data systems at each health plan and were mailed a study invitation letter. The letter explained the purpose of the MENU Choices trial. Interested individuals were directed to a study Web site, where they were screened for eligibility, provided informed consent, and completed a baseline assessment. Data for the present analyses come from the eligibility screening and baseline assessment.

Potential participants received a \$2 preincentive with their invitation letter to encourage visits to the Web site. All participants enrolled between September 2005 and March 2006. The current article represents a secondary analysis of the baseline data.

### Measures

#### Demographics

Participants reported their age, sex, race/ethnicity, marital status, education, health plan membership, height, weight, and other relevant demographic characteristics. Body mass index was calculated from height and weight.

#### Dietary Restrictions and Preferences

Participants reported dietary restrictions and food preferences from a list of common dietary regimens (low cholesterol, low salt, diabetic, lactose-restricted, low carbohydrate, vegetarian, or vegan).

#### Responsibility for Diet

Participants were asked to indicate how much responsibility they had for planning their meals, shopping for food,

and cooking. For descriptive purposes, responses were collapsed into 2 categories: *all/most* or *other*.

#### Smoking Status

Respondents indicated if they had smoked at least 100 cigarettes in their lifetime (*yes/no*) and whether they had smoked even a puff in the past 7 days (*yes/no*). Current smoking was defined by answering *yes* to both items. Participants who were not current smokers were defined as nonsmokers.

#### FV Intake

FV intake was assessed using NCI's Fruit and Vegetable All Day Screener.<sup>36</sup> This assessment allows estimation of average daily intake of both fruit and vegetable servings for purposes of determining differences between groups. A copy can be obtained at <http://riskfactor.cancer.gov/diet/screeners/fruitveg/allday.pdf>.

#### Self-Efficacy

Respondents rated their confidence in being able to meet the daily recommended allowances of both fruits (2 or more daily servings) and vegetables (3 or more daily servings) using a 10-point Likert-type scale ranging from 1 (*not at all confident*) to 10 (*extremely confident*).

#### Motivation

Respondents were asked to rate their overall motivation for either meeting or continuing to meet the daily recommended intake of fruits (2–4 servings) and vegetables (3–5 servings). The online algorithm allowed this item to be tailored as appropriate to reflect each person's current status. Separate items assessed motivation to eat FV, each using a 10-point Likert-type scale ranging from 1 (*not at all*) to 10 (*extremely motivated*).

Motivation for eating more FV was also assessed using an adapted version of the Treatment Self-Regulation Questionnaire measure.<sup>37,38</sup> A longer 14-item version of this adapted measure has been used previously to characterize intrinsic/extrinsic motivation for FV intake.<sup>33</sup> We found that a 9-item version of this measure resulted in greater internal consistency for each subscale ( $\alpha = .81$  for each) than we observed with the 14-item measure. Respondents were presented with a list of reasons for which people decide to eat FV and were then asked to rate how true each statement was for them on a 7-point Likert-type scale ranging from 1 (*not true*) to 7 (*very true*). The measure included 5 statements reflecting intrinsic motivation (eg, to take responsibility for my own health, to improve my physical health) and 4 reflecting extrinsic

motivation (eg, others would be upset if I didn't, I don't want to let others down).

### *Outcome expectations*

We assessed participants' expectations that eating at least 5 servings of FV a day would decrease their risk for cancer, diabetes, obesity, and heart disease. For each condition, participants rated the likelihood that eating 5 or more daily servings of FV would decrease their risk of developing that disease. Items were scored on a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*extremely*). Higher scores were indicative of greater expectations for reduced disease risk.

### **Statistical Analyses**

Demographic characteristics were summarized for the entire baseline sample and by smoking-status group using descriptive statistics. Group differences were examined using chi-square analyses for categorical variables and *t* tests for continuous variables. Similar analyses were used to test associations between total daily servings of FV and each participant characteristic listed in Table 1. Daily servings of FV were calculated using the publicly available scoring criteria for NCI's Fruit and Vegetable All Day Screener (available at <http://riskfactor.cancer.gov/diet/screeners/fruitveg/scoring/allday.html>) with fried potatoes/french fries removed from reports of vegetable intake. To eliminate potential bias introduced by extreme outliers, reports of 10 or more daily servings for either fruits or vegetables were dropped from the analyses and total combined FV servings were limited to no more than 20 per day. This eliminated 47 (1.9%) observations from the fruit analyses, 32 (1.3%) from the vegetable analyses, and 72 (2.9%) from the combined serving analyses, but did not impact study outcomes.

The smoking and nonsmoking groups were compared using unadjusted *t* tests and analyses of covariance (ANCOVAs), adjusting for all participant characteristics found to be associated with daily FV servings. Because FV serving data was skewed, intake of fruit, vegetables, and combined FV were analyzed using log-transformed, as well as original, serving values. For ease of interpretation, mean values from the original untransformed scale are presented, as well as effect size measures based on the untransformed analyses. However, statistical inference results from both untransformed and log transformed analyses are presented. Covariate analyses were conducted using log transformed FV servings.

Primary constructs of interest—motivation, self-efficacy, and outcome expectations—were also compared by smoking group using similar unadjusted and adjusted analyses,

controlling for covariates associated with total FV intake (see the Results section and Tables for a listing of covariates). Finally, to estimate effect size of the difference between the proportion of smokers and nonsmokers who endorsed various health outcomes associated with eating FV (see Figure 1), we conducted logistic regression analyses to obtain odds ratios and confidence intervals.

## **RESULTS**

### **Participant Characteristics**

#### *Demographics*

Ten percent of the overall sample reported current smoking, 69% were female, and 72% were married or living with a partner. Two-thirds (66%) self-identified as white, 22% as black, 2% as Asian, 0.3% as Native American, and the remainder as mixed race. Mean age was 46 years (*SD* = 10.8) and average BMI was 28.7 (*SD* = 6.5). Recruitment was evenly distributed across sites.

Participant characteristics are presented by smoking status in Table 1. Smoking groups differed in the percentage of participants who were married or living with a partner (60% smokers vs 74% nonsmokers,  $p < .001$ ) and in the proportion of the sample who attended at least some college (74% smokers vs 86% nonsmokers,  $p < .001$ ). Otherwise, no significant demographic differences were observed.

#### *Dietary Needs and Responsibilities*

Only a small proportion of the entire sample reported any special dietary needs, but group differences were observed. Nonsmokers were more likely to report being on a lactose-intolerant diet (4% vs 1%,  $p = .02$ ), low carbohydrate diet (8% vs 4%,  $p = .05$ ), and low salt diet (11% vs 7%,  $p = .04$ ). There were no differences in the proportion who were vegan, vegetarian, or following a diabetic or low cholesterol diet (see Table 1). There were also no differences in the proportion of smokers and nonsmokers who reported responsibility for meal planning, food shopping, or cooking.

### **Daily FV Intake**

Twenty percent of smokers ate at least 5 combined servings of FV per day compared with 35% of nonsmokers ( $p < .001$ ). Mean servings per day also differed, with current smokers eating fewer daily servings of fruits ( $M = 1.5$  vs  $2.0$ ,  $p < .001$ ,  $d = 0.33$ ), vegetables ( $M = 2.2$  vs  $2.5$ ,  $p = .004$ ,  $d = 0.20$ ), and combined FV ( $M = 3.7$  vs  $4.5$ ,  $p < .001$ ,  $d = 0.32$ ) than nonsmokers (see Figure 2). Group differences remained the same when compared using log-transformed serving values, except that the difference in vegetable servings became more significant ( $p = .001$ ).

**TABLE 1. Participant Characteristics by Smoking Status and Factors Associated With Fruit and Vegetable (FV) Intake**

Characteristic	Current smoker (N = 261)		Nonsmoker (N = 2,241)		<i>p</i> <sup>a</sup>
	<i>n</i>	%	<i>n</i>	%	
Female	180	69	1540	69	.935
Site <sup>b</sup>					.078
1	49	19	475	21	
2	60	23	454	20	
3	52	20	396	18	
4	62	24	448	20	
5	38	15	468	21	
Married/live with partner <sup>c</sup>	155	60	1,643	74	< .001
White <sup>c</sup>	168	66	1,478	67	.749
Some college or more education <sup>c</sup>	193	74	1,912	86	< .001
Special diets					
Vegetarian <sup>c</sup>	4	2	52	2	.415
Vegan	0	0	6	0	.403
Low cholesterol diet <sup>c</sup>	28	11	239	11	.975
Diabetic diet	16	6	103	5	.270
Lactose intolerant diet	3	1	90	4	.021
Low carb diet <sup>b</sup>	11	4	169	8	.049
Low salt diet <sup>c</sup>	18	7	245	11	.044
Responsible for <sup>c</sup>					
Meal planning <sup>b</sup>	185	71	1,601	72	.790
Shopping for food	187	72	1,595	72	.993
Cooking	178	68	1,550	70	.649
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age <sup>d</sup>	45.8	10.6	46.4	10.8	.403
BMI <sup>d</sup>	28.9	6.3	28.7	6.6	.666

<sup>a</sup>Significance of comparison between smoking status groups.<sup>b</sup>Associated with total daily FV intake at  $p \leq .01$ .<sup>c</sup>Associated with total daily FV intake at  $p \leq .001$ .<sup>d</sup>Associated with total daily FV intake at  $p \leq .05$ .<sup>e</sup>Proportion reporting *all* or *most* responsibility for planning meals, food shopping, or cooking meals.

Participant characteristics associated with total combined FV servings (log-transformed) were analyzed and included recruitment site, marital status, race, education, dietary needs (vegetarian, low cholesterol diet, low carbohydrate diet, low salt diet), and responsibility for meal planning (see Table 1). Similar results were obtained using untransformed FV servings.

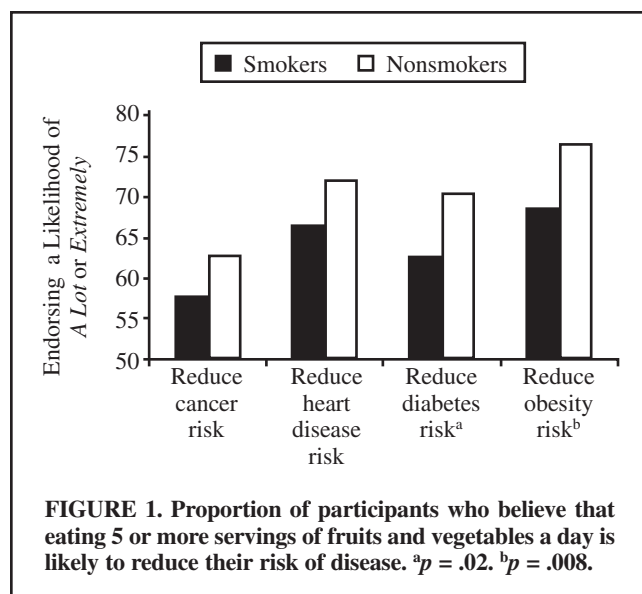
FV intake by smoking group was re-analyzed controlling for covariates associated with FV intake. Smoking groups continued to differ in their daily fruit intake (marginal  $M = 1.5$  vs 2.0 for smokers vs nonsmokers,  $p < .001$ ) and combined FV intake (marginal  $M = 3.8$  vs 4.5 for smokers vs

nonsmokers,  $p < .001$ ), and a trend toward significance was observed for daily vegetable intake (marginal  $M = 2.3$  vs 2.5 for smokers vs nonsmokers,  $p = .07$ ). Log-transformed analyses remained the same, except the difference in vegetable servings became more significant ( $p = .03$ ).

#### Self-Efficacy, Motivation, and Outcome Expectations

Smokers reported lower overall motivation, self-efficacy, and intrinsic motivation for eating the daily recommended servings of FV. These differences were generally unchanged after controlling for relevant covariates associated with total FV intake. However, differences in self-efficacy for eating

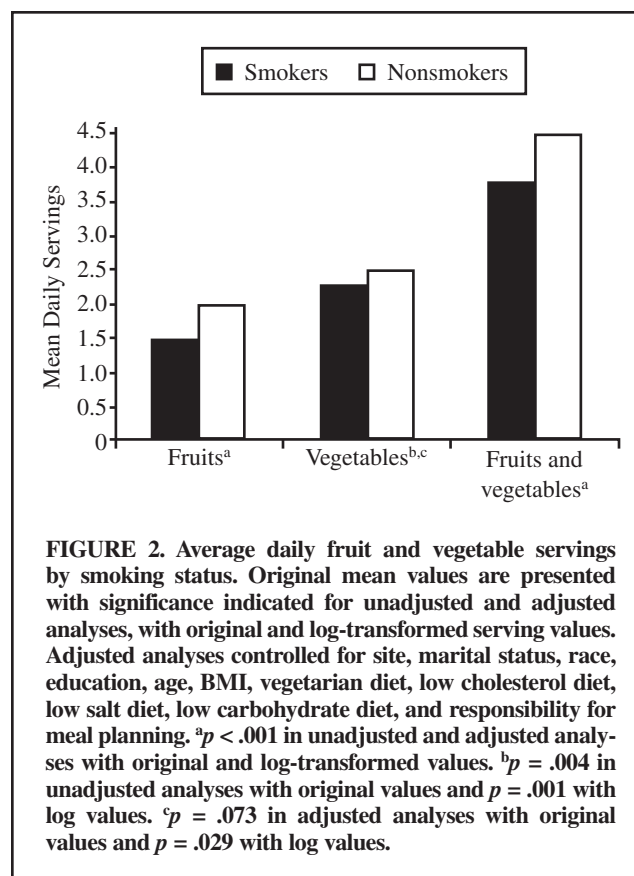




more vegetables were no longer statistically significant (see Table 2).

To better understand smokers' motivation for wanting to eat more FV, we compared the groups' scores on each intrinsic motivation scale item. Significant differences were observed for 2 items—smokers were less motivated by having a “strong value for eating healthy” ( $M = 4.7$  vs  $5.3$ ,  $p < .001$ ,  $d = 0.38$ ) or because it was “consistent with [their] life goals” ( $M = 5.1$  vs  $5.7$ ,  $p < .001$ ,  $d = 0.34$ ). A trend toward significance was observed for a third item—smokers were slightly less likely to endorse wanting to eat FV to “take responsibility” for their health ( $M = 6.4$  vs  $6.5$ ,  $p = .06$ ,  $d = 0.12$ ).

Overall, smokers endorsed lower expectations that eating FV would reduce their disease risk, although only expectations for reduced risk of diabetes was significantly different between groups when overall mean scores were compared (see Table 2). We also examined the proportion of each smoking status group who believed that eating 5 or more servings of FV each day was likely to reduce their risk of disease (ie, those who rated the likelihood as *a lot* or *extremely*). The majority of participants in both groups recognized the health benefits of eating FV, but fewer smokers believed that eating the recommended 5 A Day<sup>39</sup> servings would reduce their risk of diabetes (63% vs 71%,  $p = 0.05$ , odds ratio [OR] = 0.72, 95% confidence interval [CI] = 0.55 to 0.94) or obesity (69% vs 77%,  $p = .03$ , OR = 0.68, 95% CI = 0.51 to 0.90; see Figure 1). No significant difference was observed for heart disease risk (67% vs 72%,  $p = .07$ , OR = 0.78, 95% CI = 0.59 to 1.03) or cancer risk (58% vs 63%,  $p = .14$ , OR = 0.82, 95% CI = 0.63 to 1.07).



## COMMENT

This study's findings replicate prior research demonstrating that smokers have poorer diets than nonsmokers<sup>5-7</sup> and extend this work by examining factors that can help explain observed discrepancies and may serve as targets for future intervention. Smokers ate fewer daily servings of FV than nonsmokers and fewer smokers met the CDC's minimum 5 A Day recommendation. Dietary differences were most pronounced for fruit intake. Smokers reported eating half a serving less per day of fruit, and this difference remained significant even after controlling for other relevant covariates.

Clearly the most important thing that smokers can do to improve and protect their health is to quit smoking, but this is a difficult goal for most. Less than 3% of smokers in the US successfully quit using tobacco each year.<sup>40</sup> Therefore, efforts to improve the health of smokers should not be limited to tobacco cessation. Smokers should be encouraged to, and aided in, making other lifestyle changes, including eating more FV. Eating a diet rich in fruits and vegetables is associated with a range of health benefits including

decreased blood pressure; improved weight management; and decreased risk for type II diabetes, stroke, and certain cancers.<sup>1</sup> These benefits are particularly important for smokers, who are already at increased risk for many of these conditions as a result of their tobacco use.<sup>41</sup> Furthermore, the apparent risk posed to smokers by taking certain dietary supplements<sup>14–16</sup> and the evident protective effects of FV in this population<sup>17–22</sup> underscore the importance of smokers eating a healthy, well-balanced diet rich in FV.

The challenge facing researchers and health care providers is not whether, but how, to improve people's diets. SCT and SDT point to potentially important mediators and moderators of behavior change and offer targets for intervention. The results of this study help refine our understanding of how smokers differ from nonsmokers across several constructs key to these theories—motivation, self-efficacy, and outcome expectations for disease reduction. Our data suggest that smokers have different attitudes and beliefs about eating healthy than nonsmokers. Smokers were less motivated to meet the 5 A Day recommendation and had less confidence, or self-efficacy, in their ability to do this. Their reasons for wanting to eat FV also differed. Although both groups were more driven by their perceived personal benefits of eating healthy than by external factors such as pleasing others, smokers reported that they were less driven by intrinsic motivational factors overall. In particular, eating healthy was less of a life goal or valued behavior for smokers.

This may not be surprising given smokers' proclivity for unhealthy behavior in general.

Dietary interventions should take into account smokers' lower motivation and self-efficacy and emphasize change in these areas. Because outcome expectations influence motivation, one way to do this is to focus on the health benefits of eating FV. Proportionally fewer smokers in this study expected that eating a 5 A Day diet was likely to reduce their risk of diabetes or obesity, and a trend toward a significant difference was observed for heart disease. Although the link between diet and disease risk seems ever present in the lay media, this message may not be reaching smokers. Or perhaps, smokers do not believe that changes in their diets can offset the health risks posed by their smoking. We cannot tease this conclusion out from our data, but it is clear that smokers need more education about why eating healthy is important. For this information to be most salient, it should emphasize the particular benefits of eating healthy for smokers, such as potentially reducing disease susceptibility associated with oxidative stress, offering a potential protective advantage against lung cancer<sup>17–21</sup> and reducing cardiovascular disease risk.<sup>22</sup>

### Strengths and Limitations

This study has several noteworthy design strengths, which include the use of a large, population-based sample drawn from 5 regions of the US and generally lenient inclusion cri-

**TABLE 2. Comparison of Smokers and Nonsmokers on Motivation, Self-Efficacy, and Outcome Expectations**

Variable	Current smoker		Nonsmoker		<i>d</i>	<i>p</i>	Adj <i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Motivation							
Fruit	6.9	2.4	7.7	2.2	0.34	<.001	<.001
Vegetables	7.4	2.2	7.6	2.2	0.18	.007	.041
Intrinsic	5.9	0.9	6.1	0.9	0.27	<.001	<.001
Extrinsic	2.4	1.6	2.6	1.6	0.08	.155	.127
Self-efficacy							
Fruit	6.9	2.4	7.6	2.2	0.30	<.001	<.001
Vegetables	7.2	2.2	7.5	2.1	0.13	.053	.191
Expectation							
Reduce cancer risk	3.7	1.0	3.8	1.0	0.04	.537	.646
Reduce heart disease risk	3.9	0.9	3.9	0.9	0.09	.185	.185
Reduce diabetes risk	3.8	1.0	3.9	0.9	0.13	.042	.026
Reduce obesity risk	3.9	1.0	4.1	0.9	0.13	.083	.056

*Note.* Unadjusted mean values are presented with significance indicated for unadjusted and adjusted analyses. Effect size estimates (*d*) are based on unadjusted analyses. Adjusted analyses are controlled for site, marital status, race, education, age, BMI, vegetarian diet, low cholesterol diet, low salt diet, low carbohydrate diet, and responsibility for meal planning.

teria that ruled out only the most ill. Although the proportion of smokers in our sample (10%) is lower than the national average, it is generally consistent with the smoking prevalence at the represented health plans (ranging from ~7.5% to ~15%). Because participation required access to the Internet either at home, work, or another source (eg, libraries), the findings may not generalize to all demographic strata. However, we believe that they are fairly representative of the approximately 3 million people who receive care from the represented organizations. Additionally, the presented analyses do not inform how current smokers compare with former smokers, because these individuals were included with never smokers to form the current nonsmoker comparison group. We originally examined differences across each of these 3 groups separately and found similar main outcome results. Thus, for ease of interpretation, we collapsed former and never smokers in the presented findings; however, it should not be assumed that former and never smokers always have similar beliefs and dietary behaviors. Finally, our use of cross-sectional data prevents us from concluding that the differences between smokers' and nonsmokers' dietary attitudes and beliefs are responsible for the observed differences in FV intake, but there is sound rationale for the importance of motivation, self-efficacy, and outcome expectations to behavior change.<sup>24,25,27,42,43</sup>

## Conclusion

Future studies should examine whether the observed baseline differences impede smokers' ability to modify their diets in response to intervention. In the meantime, our findings provide additional evidence that smokers eat fewer FV than nonsmokers, enhance our understanding of smokers' attitudes and beliefs about FV intake, and suggest specific targets for intervention to promote dietary change in this population.

## ACKNOWLEDGEMENTS

The authors would like to thank the staff of the Center for Health Communications at the University of Michigan for their effort in programming the MENU Choices survey and Web-based intervention. We would also like to thank Jerianne Heimendinger, ScD, MPH, RD; Fran Thompson, PhD; Tom Hurley, PhD; Linda Nebeling, PhD; and Marci Campbell, PhD, for consulting on the dietary data analyses and Ken Resnicow, PhD, for providing our intrinsic and extrinsic motivation measure.

This project was funded by a grant from the National Cancer Institute (U19 CA079689) and was conducted in collaboration with the Cancer Research Network (CRN).

## NOTE

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